Direct Imaging Detectors and Interferometers: Development Status

Hiroshi Matsuo[1], Hirohisa Nagata[1], Izumi S. Ohta[1], Hajime Ezawa[1], Seiichiro Ariyoshi[2], and Makoto Hattori[3]

(Email: h.matsuo@nao.ac.jp)

[1]National Astronomical Observatory of Japan
[2]Institute of Physical and Chemical Research (RIKEN), Japan
[3]Astronomical Institute, Tohoku University, Japan

Performance evaluation of superconducting direct detectors and demonstration of aperture synthesis imaging using a double input Fourier spectrometer is presented. Superconducting direct detectors using niobium tunnel junctions show superior sensitivity and high dynamic range. The detectors consist of 12-element distributed niobium junctions of about 2 micron in diameter and log-periodic antennas. Input coupling is optimized at 650 GHz and have 10% bandwidth that is tuned by the distributed junctions. Measurement of quantum efficiency and current noise gives NEPs of 1×10^{-16} W Hz^2 at operating temperature of less than 0.8 K and dynamic range larger than 106. The aperture synthesis interferometer consists of Martin-Puplett type interferometer with double input aperture. Spectral information as well as polarization and imaging information were successfully retrieved using a bolometric detector in submillimeter-wave. The interferometer demonstrated advantages over conventional heterodyne interferometer, such as wide frequency coverage, large dynamic range and use of high sensitivity direct detectors.

Comments. The development is made in Advanced Technology Center of NAOJ for future application to Terahertz Space Projects, such as SPECS. The presentation will be focused on the first laboratory demonstration of new detector and interferometer technology that we are applying to ground based observations in coming years, one on ASTE (Atacama Submillimeter Telescope Experiment) and another in Nobeyama Radio Observatory for SZ observations of nearby cluster of galaxies.

From Spitzer to Herschel and Beyond Pasadena, California, June 2004 Conference Program and Abstracts